

Description of Invention  
For the author's Certificate

N373005

1  
51

Claimed 29.03.1971

Published 12.03.1973

The description was published 16.05.1973

Inventors: V.T.Rogatchev, B.V.Smolyarov, V.A.Kamensky, A.E.Shevcov, A.V.Gridin,  
I.V.Isayev, L.F.Bandakov

Hydraulic needle free injector

The invention relates to the medical devices, particularly to the hydraulic needle free injectors.

The injection device with a housing, pedal pump, one hose, trigger and ball lock holding a rod, is known.

The suggested injection device is characterized by having a removable orifice before the nozzle, the pedal of the hydraulic pump consists of two regulated hinged parts and the hydraulic pump has a compensating reservoir.

It provides the possibility to regulate the medicine jet penetration depth and the force applied to the pump pedal according to the preset dose.

The compensating reservoir can consists of a cylinder, a piston and a supporting screw, and there should be a clearance between the pedal roll and the hydraulic pump.

In the Picture 1 a cross-section of the suggested hydraulic needle free injector is shown; in the Picture 2 –the cross-section of the hydraulic pump.

The suggested hydraulic needle free injector has a housing 1, where a rod 2 with a rubber O-ring 3, supported by a power springs 4 and 5, is installed. On the right end of the rod 2 a ring groove is made along the balls radius 6. The balls are recessed in the separator 7, supported by a nut 8. In the nut 8 a button 9 and a spring 10 are installed. The button 9 keeps the balls 6 from falling out from the separator 7, and the spring 10 is pushing the button 9. The nut 8 is connected through a thread with a movable nut 11, which can move on the thread in the housing 1. The handle 12 is connected with a nut 11 with the help of a spline. A trigger lever is installed 13 in this handle. On the front side of the housing 1 the injector head is fixed with a nut 14. In the injector head the plunger 15 with a rubber O-ring 16 and a bushing 17 are installed. In the bushing 17 a check-valve 18 is located. On the head the head-nut 19 is screwed on. In which an injector nozzle 20 is made. Before the nozzle 20 a removable orifice 23 is installed with a rubber O-rings 21 and 22. On the left end of the rod the protrusion is made, which is engaged with the plunger 15. In the upper sleeve of the head a suction check valve 24, mesh filters 25 and a suction hydraulic pipe 26 are installed. A bottle 27 with a plug 28 is fixed on the pipe. In the housing 1 a sleeve 29 is made to supply the hydraulic fluid into the cavity before the rod 2. A rubber O-ring 30 protects the hydraulic fluid from leaking into the left cavity of the injector. Hydraulic pump has a compensating reservoir 31, which consists of a cylinder, piston 32 with an O-ring 33 and a regulating screw 34: a plunger 35 is made with a rubber O-ring 36. In the housing eye-ends (not shown on the drawing) with the help of an axle 37 a bracket 38 with a spring 39 is installed. There is a clearance  $a$  between a roll 40 located

2

on the bracket on the axis 41 and the plunger 35. By means of an axle 42 and an interlock 43 the bracket is connected with a pedal 44, which consists of two regulated hinged parts. The hydraulic pump housing is installed on the platform 45 and it is enclosed into a casing 46.

The device is operating in the following way. When the pedal 44 is being pressed with a foot, the bracket 38 turns around the axis 37, passes the clearance  $a$  and, under the action of the roll 40 the plunger 35 begins to move and to push the hydraulic fluid from under the plunger cavity. The hydraulic fluid is pressing down on the rod 2, which moves, compressing the springs 4 and 5 until the balls 6 get into the rod ring groove. Under the action of the spring 10 the button 9 moves and with its conical surface pushes the balls 6 into the rod ring groove 2, locking them there. Simultaneously, when cocking the rod 2 the medicine goes by the hydraulic pipe 26 through the check-valve 24 and the mesh-filters 25 from the bottle 27 into the cavity under the plunger 15.

For making an injection it is necessary to take the foot out of the pedal 44 and to press the lever 13, which transfers the force onto the button 9. The button 9 being recessed in the housing, releases the balls 6, afterwards the rod 2 under the action of the springs 4 and 5, simultaneously acting on the plunger 15, moves to the left and creates the medicine pressure. Under the pressure the check-valve 24 closes and the check-valve 18 lets the medicine come to the orifice 23 and to the nozzle 20, resulting in a rapid medicine outflow.

The dose of the injected medicine is regulated by the motion of the ball lock with the help of the handle 12 rotation according to the scale on the housing 1.

For subcutaneous and intravenous injections a jet needs to have a lower energy. For this purpose the orifice 23 is installed before the nozzle, which is forming the jet. For compensation of possible leaks of the hydraulic fluid during the long-term operation, the screw 38 moving the piston 32, is being turned until the clearance  $a$  reaches the preset value.

When operating in the climate with high temperatures the volume of the hydraulic fluid get bigger. The plunger 35 moves to the right and takes up the clearance  $a$ , which is initially set in a way that at the possible maximum temperature (for example,  $+60^{\circ}\text{C}$ ) it would be taken up to zero. If such a clearance is not made, in case of the temperature rise the dose of the injected medicine can get smaller.

## CLAIMS

1. A hydraulic needle free injector, which has a housing, a powered rod, a medicine supply system, a hydraulic pedal pump and a hydraulic pipe and is characterized by having the orifice installed before the nozzle. This nozzle allows to regulate the depth of the injected medicine penetration and the force applied to the hydraulic pump pedal according to the preset dose. The hydraulic pump pedal consists of two regulated hinged parts, and the hydraulic pump is made with the compensating reservoir.
2. The hydraulic needle free injector from the item 1 is characterized by having the compensating reservoir which consists of a cylinder, a piston with a screw, and there should be a clearance between the pedal roll and the hydraulic pump plunger.